Claims

What is claimed is:

1. A method for executing database queries, the database comprising a first table (T1) having a primary key (PK) column and a first correlated value column (CV_1) and a second table (T2) having a foreign key (FK) column related to the primary key column of the first table and a second correlated value column (CV_2), comprising the steps of:

preparing a database query for execution based at least in part on application of a derived constraint rule (DCR) having the following form:

$$(PK = FK) \rightarrow CV_2 + C_1 \leq CV_1 \leq CV_2 + C_2$$

where C_1 and C_2 are constants, and "$\rightarrow$" means "implies," to produce an execution plan;

including abort steps conditioned on changes in the DCR in the execution plan; and

executing the plan.

2. The method of claim 1, further comprising the step of including lock acquisition steps in the execution plan prior to the abort steps.

3. The method of claim 1, further comprising the step of placing locks barring at least inserts and updates of T2 and updates of T1 from before execution until after execution.

4. The method of claim 1, further comprising the step of determining that inserts and updates that result in modification of the DCR are rare.

5. The method of claim 1, further comprising the step of determining that inserts and updates that result in modification of the DCR are rarely concurrent with queries.

6. A method for executing database queries, the database comprising a first table (T1) having a primary key (PK) column and a first correlated value column (CV_1) and a second table (T2) having a foreign key (FK) column related to the primary key column of the first table and a second correlated value column (CV_2), comprising the steps of:

preparing a database query for execution based at least in part on application of a derived constraint rule (DCR) having the following form:

$(PK = FK) \rightarrow CV_2 + C_1 \leq CV_1 \leq CV_2 + C_2$

where C_1 and C_2 are constants, and "→" means "implies," to produce an execution plan that includes one or more DCR dependent steps;

including update steps conditioned on changes in the DCR in the execution plan, the update steps modifying the DCR dependent steps based at least in part on those changes; and

executing the plan.

7. The method of claim 6, further comprising the step of including lock acquisition steps in the execution plan prior to the update steps.

8. The method of claim 6, further comprising the step of placing locks barring at least inserts and updates of T2 and updates of T1 from before execution until after execution.

9. The method of claim 6, further comprising the step of including abort steps dependent on changes in the DCR and a DCR dependent step executing prior to an update step.

10. A method for executing database queries, the database comprising a first table (T1) having a primary key (PK) column and a first correlated value column (CV_1) and a second table (T2) having a foreign key (FK) column related to the primary key column of the first table and a second correlated value column (CV_2), comprising the steps of:

storing a derived constraint rule (DCR) having the following form:

$(PK = FK) \rightarrow CV_2 + C_1 \leq CV_1 \leq CV_2 + C_2$

where C_1 and C_2 are constants, and "→" means "implies," in a database system dictionary;

placing a read lock on the stored DCR;

after placing the read lock, preparing a database query for execution based at least in part on application of the DCR to produce an execution plan; and

executing the plan.

11. The method of claim 10, further comprising the step of determining that inserts and updates that result in modification of the DCR are frequent.

12. The method of claim 10, further comprising the step of determining that inserts and updates that result in modification of the DCR are frequently concurrent with queries.

13. A computer program, stored on a tangible storage medium, for executing database queries, the database comprising a first table (T1) having a primary key (PK) column and a first correlated value column (CV_1) and a second table (T2) having a foreign key (FK) column related to the primary key column of the first table and a second correlated value column (CV_2), the program comprising executable instructions that cause one or more computers to:

prepare a database query for execution based at least in part on application of a derived constraint rule (DCR) having the following form:

$$(PK = FK) \rightarrow CV_2 + C_1 \leq CV_1 \leq CV_2 + C_2$$

where C_1 and C_2 are constants, and "$\rightarrow$" means "implies," to produce an execution plan;

include abort steps conditioned on changes in the DCR in the execution plan; and

execute the plan.

14. The computer program of claim 13 further comprising executable instructions that cause a computer to include lock acquisition steps in the execution plan prior to the abort steps.

15. The computer program of claim 13 further comprising executable instructions that cause a computer to place locks barring at least inserts and updates of T2 and updates of T1 from before execution until after execution.

16. The computer program of claim 13 further comprising executable instructions that cause a computer to determine that inserts and updates that result in modification of the DCR are rare.

17. The computer program of claim 13 further comprising executable instructions that cause a computer to determine that inserts and updates that result in modification of the DCR are rarely concurrent with queries.

18. A computer program, stored on a tangible storage medium, for executing database queries, the database comprising a first table (T1) having a primary key (PK) column and a first correlated value column (CV_1) and a second table (T2) having a foreign key (FK) column related to the primary key column of the first table and a second correlated value column (CV_2), the program comprising executable instructions that cause one or more computers to:

prepare a database query for execution based at least in part on application of a derived constraint rule (DCR) having the following form:

$$(PK = FK) \rightarrow CV_2 + C_1 \leq CV_1 \leq CV_2 + C_2$$

where C_1 and C_2 are constants, and "$\rightarrow$" means "implies," to produce an execution plan that includes one or more DCR dependent steps;

include update steps conditioned on changes in the DCR in the execution plan, the update steps modifying the DCR dependent steps based at least in part on those changes; and

execute the plan.

19. A database system for executing database queries, comprising:

one or more nodes;

a plurality of CPUs, each of the one or more nodes providing access to one or more CPUs;

a plurality of virtual processes, each of the one or more CPUs providing access to one or more virtual processes;

each virtual process configured to manage data, including rows organized in tables, stored in one of a plurality of data-storage facilities;

a first table (T1) having a primary key (PK) column and a first correlated value column (CV_1);

a second table (T2) having a foreign key (FK) column related to the primary key column of the first table and a second correlated value column (CV_2), and

an optimizer configured to:

prepare a database query for execution based at least in part on application of a derived constraint rule (DCR) having the following form:

$$(PK = FK) \rightarrow CV_2 + C_1 \leq CV_1 \leq CV_2 + C_2$$

where C_1 and C_2 are constants, and "→" means "implies," to produce an execution plan that includes one or more DCR dependent steps; and

include update steps conditioned on changes in the DCR in the execution plan, the update steps modifying the DCR dependent steps based at least in part on those changes.

20. A database system for executing database queries, comprising:

one or more nodes;

a plurality of CPUs, each of the one or more nodes providing access to one or more CPUs;

a plurality of virtual processes, each of the one or more CPUs providing access to one or more virtual processes;

each virtual process configured to manage data, including rows organized in tables, stored in one of a plurality of data-storage facilities;

a first table (T1) having a primary key (PK) column and a first correlated value column (CV_1);

a second table (T2) having a foreign key (FK) column related to the primary key column of the first table and a second correlated value column (CV_2), and

an optimizer configured to:

prepare a database query for execution based at least in part on application of a derived constraint rule (DCR) having the following form:

$$(PK = FK) \rightarrow CV_2 + C_1 \leq CV_1 \leq CV_2 + C_2$$

where C_1 and C_2 are constants, and "→" means "implies," to produce an execution plan; and

include abort steps conditioned on changes in the DCR in the execution plan.

21. The database system of claim 20 where the optimizer is further configured to include lock acquisition steps in the execution plan prior to the abort steps.

22. The database system of claim 20 where the optimizer is further configured to place locks barring at least inserts and updates of T2 and updates of T1 from before execution until after execution.

23. The database system of claim 20 where the optimizer is further configured to determine that inserts and updates that result in modification of the DCR are rare.

24. The database system of claim 20 where the optimizer is further configured to determine that inserts and updates that result in modification of the DCR are rarely concurrent with queries.

25. A computer program, stored on a tangible storage medium, for executing database queries, the database comprising a first table (T1) having a primary key (PK) column and a first correlated value column (CV_1) and a second table (T2) having a foreign key (FK) column related to the primary key column of the first table and a second correlated value column (CV_2), the program comprising executable instructions that cause one or more computers to:

store a derived constraint rule (DCR) having the following form:

$$(PK = FK) \rightarrow CV_2 + C_1 \leq CV_1 \leq CV_2 + C_2$$

where C_1 and C_2 are constants, and "$\rightarrow$" means "implies," in a database system dictionary;

place a read lock on the stored DCR;

after placing the read lock, prepare a database query for execution based at least in part on application of the DCR to produce an execution plan; and

execute the plan.

26. A database system for executing database queries, comprising:

one or more nodes;

a plurality of CPUs, each of the one or more nodes providing access to one or more CPUs;

a plurality of virtual processes, each of the one or more CPUs providing access to one or more virtual processes;

each virtual process configured to manage data, including rows organized in tables, stored in one of a plurality of data-storage facilities;

a first table (T1) having a primary key (PK) column and a first correlated value column (CV_1);

a second table (T2) having a foreign key (FK) column related to the primary key column of the first table and a second correlated value column (CV_2), and

an optimizer configured to:

store a derived constraint rule (DCR) having the following form:

$$(PK = FK) \rightarrow CV_2 + C_1 \leq CV_1 \leq CV_2 + C_2$$

where C_1 and C_2 are constants, and "$\rightarrow$" means "implies," in a database system dictionary;

place a read lock on the stored DCR; and

after placing the read lock, prepare a database query for execution based at least in part on application of the DCR to produce an execution plan.